AGRICULTURAL Research

SEPTEMBER 1955

Gin: does new jobs

• see page 8

Wool: bred to fit

• see page 3

Dust: now it flows

• see page 14

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL Research

Vol. 4—September 1955—No. 3

CONTENTS

Flowing Dust 14

LIVESTOCK

Tailoring Wool to Textile Needs 3

CROPS AND SOILS

All-season Forage 6
How To Tell When Corn Will Mature 7
What Makes the Hard Seeds Sprout 7
Better Ginning Through Research 8

POULTRY

More Pounds on Less Feed 10

DAIRY

Cattle Researchers Watch the Weather 11

FOOD AND HOME

Frozen Fried Chicken—How Does It Keep? 12

FRUITS AND VEGETABLES

Apple Handling Made Easier 13
Found: How Peach Mosaic Is Spread 15

AGRISEARCH NOTES

Effective Insecticides for Mosquito Larvae 16
New Restrictions to Prevent VE Spread 16
Promise of Sprout Inhibitor for Potatoes 16

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Flow of ideas

Scientists run into one barrier after another—curtains that must be pierced before we can move ahead.

Take the *grass* curtain.

We want more productive pastures, with better varieties of grasses and legumes. But we need better preliminary tests for evaluating forage. Our present grazing tests are open to great error. They're expensive. And even with sheep as the test animal, such studies take a long time.

What about a good test-tube method to check rate of gain? One approach would be to develop rumen microorganisms as testers. But we don't know enough about the rumen and what happens when grass goes through the animal.

Entomologists are wondering if we might use a much smaller grazer—the armyworm—to evaluate new forages.

That seems daring, but insects are being used along these lines in other research. We've reported (July 1955, p. 11) how fruit flies are helping to determine the effectiveness of various types of poultry breeding. They give needed information in 2 weeks—instead of 2 years as required with chicks.

So it might be possible to use the armyworm or some other species to get information on rate of gain from new forage crops—perhaps even on their tendency to cause bloat.

Before we could use armyworms in grazing tests, we'd need to make a full study of the insect's nutritional requirements. That would be the first step in setting up an index to be correlated with a steer's response to different grasses.

This knowledge would be useful not only in making insects valuable as experimental tools but also in helping kill or control them with chemicals. And it would aid plant breeders in developing varieties with insect resistance.

The point is that we'll have to try many novel approaches if farmers are to raise enough food and get fair returns. We'll have to put our money on some long shots. We'll have to invest more in basic studies that are under no pressure to solve immediate needs but *will* pay off eventually.

Agriculture's competitive position in our economy depends on vigorous research. We must make sure there is a continuing flow of good ideas to use available funds to advantage.

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AGRICULTURAL RESEARCH SERVICE
United States Department of Agriculture

1. *Individual fleeces are visually sorted by length and fineness of wool before processing. A trained hand and eye sort fleece samples into main matchings, secondary matchings, and offsorts (see text). The samples are then bagged, identified, and shipped to ARS laboratories, Beltsville, Md., where they're processed and evaluated.*

2. **Staple length of 50 locks of grease wool (wool as it comes from the sheep) is measured to get the average length of the lot of wool (matching) to be processed. Researchers seek relationship between grease-wool length and fiber length of wool top from individual fleeces. This information is useful in selecting breeding animals.**

3. **Dry weight of a small sample is used to determine correct dry weight of grease wool matching and the products of each stage of processing. A 10-gram sample from each lot is dried for 30 minutes in a forced-draft oven with a built-in balance. Dry weight is needed because wools vary in amounts of moisture they absorb from the air.**

Tailoring WOOL to textile needs

SCIENTISTS WORK FROM RANGE TO MILL IN EFFORT TO BREED SHEEP THAT PRODUCE A HIGH YIELD OF TOP-QUALITY WOOL

OUR textile manufacturers want—and will pay more for—wool of uniform fineness and length, free from off-color fibers and weaknesses. Such wool is used for making worsted and woolens, two main apparel fabrics.

USDA breeding specialists are trying to develop sheep that will produce wool with these desired characteristics, along with higher fleece and mutton yields. On mountain ranges at the U. S. Sheep Experiment Station at Dubois, Idaho, the famous Rambouillet breed has been improved for uniformity in fineness of wool, and two new breeds have been established—the Columbia and the Targhee (AGR. RES., July 1953, p. 13).

The proportion of Rambouillet rams producing strictly fine-staple fleeces has been increased from 92 percent in 1942–45 to 98 percent in 1953. An average Columbia ewe produces about 12 pounds of medium-grade wool a year; an average Targhee ewe produces about 11 pounds of medium-fine to fine wool in the same period. Ram fleeces of both breeds are considerably heavier.

To provide data on processing qualities of wool from individual sheep and from groups of sheep as a guide to selective breeding, an experimental processing plant is operated at the ARS laboratories at Beltsville, Md. Scouring, carding, and combing equipment includes a commercial worsted carding machine and a French comb.

A sheep's true wool-producing ability and the value of its fleece is determined by several factors. Among

these are the yield of clean (grease-free and dirt-free) wool, staple length, and fineness of the fiber (diameter in microns—approximately 1/25,000 inch).

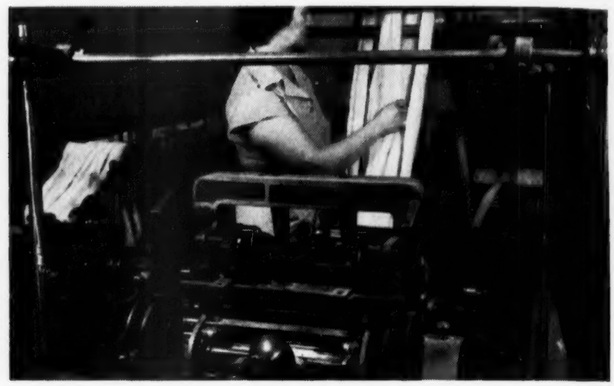
Fiber fineness and staple length vary within an individual fleece. For instance, wool from a sheep's back is finer than wool from its thigh. Before processing, fleeces are sorted visually by fineness and length of wool into main matchings or sorts (largest portion), secondary matchings (lesser portions), and offsorts (wool with vegetable matter and discolored, dungy locks).

To prepare a fleece for combing, each main matching is individually scoured and carded. The card sliver (strand of wool from carding machine) is put through several operations that straighten and distribute the fibers before combing to produce wool top (the longer fibers from the matching). Noils or waste from the combing operation are short, broken, and tangled fibers.

In one ARS experiment, selected individual fleeces from sheep of specific breeds used in crossbreeding experiments at Beltsville were scoured and carded to determine the effect of crossbreeding on yields of fleeces. A higher percentage of clean and carded wool was obtained from these crossbreds than from parental purebreds.

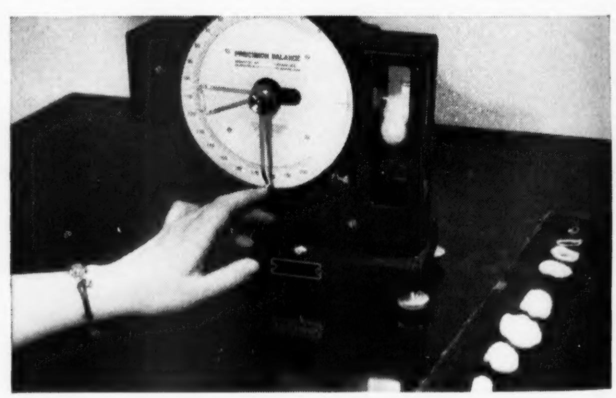
A 5-year cooperative study by the Idaho experiment station and the Dubois station to determine processing differences in wool from individual Targhees is near completion. Main sorts of 1,200 fleeces were individually sacked and shipped in bales to Beltsville for processing into wool top and for quality evaluation. Fleeces processed vary from 3 to 1 to 18 to 1 in ratio of wool top to noil; even fleeces of the same average fineness vary as much as from 9 to 1 to 14 to 1. The wool must be further analyzed for length and strength, and breeding and nutrition of the sheep will be studied.

5. Worsted carding machine removes waste (vegetable matter, dust, very short fibers) as it opens the wool and spreads it in a web. At the end of a series of metal rollers, the web of wool is gathered in a single soft sliver (strand) and then wound into a ball. Loss in weight from grease wool to card sliver averages about 50 percent.



6. Gilling is a preparatory step to combing. As the slivers of wool are fed through a series of closely set pins or teeth, the wool is opened and the fibers are straightened and distributed. An even sliver prevents damage to comb pins, cuts waste, produces the even wool top (longer fibers from the matching) needed for good spinning.

9. *Suter stapler is used to draw samples to get average fiber length and length distribution. Fibers are drawn by nippers from wool top on right side to build up sample on left—note variation in the length distribution of the fibers. Bars at half-inch intervals are dropped progressively to get samples of different length intervals.*



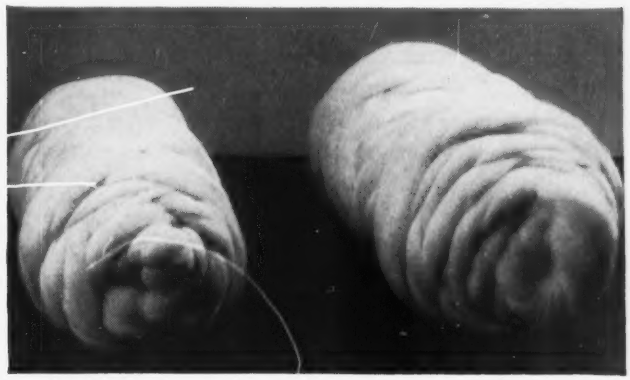
10. *Total weight is now obtained of the series of fiber samples of different lengths drawn in the stapler. The percentage of weight of fibers in each length interval is then used to calculate average length and distribution of fibers in a wool top from an individual fleece—factors used in determining sheep's wool-producing ability.*

Exploratory research into the fiber spinning properties of wool top from individually identified yearling Targhee ewes is being done under contract with the Lowell Technological Institute Research Foundation, Lowell, Mass. Differences in fiber and yarn properties among main matchings from randomly selected individual sheep have been detected in this sample study.

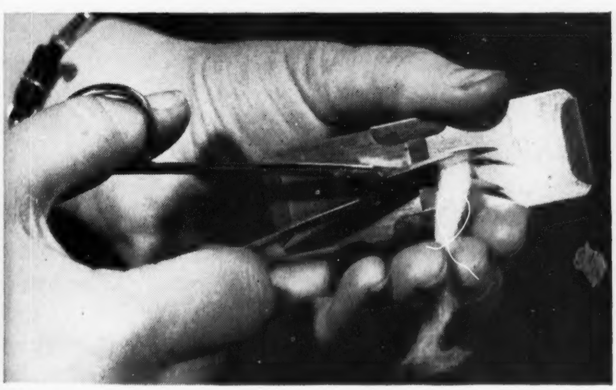
Although the processing of individual fleeces is a time-consuming job, information on yields and the quality of the wool from individual sheep makes possible more precise selection of breeding animals. In the performance of a fleece under the various processing operations, researchers are looking for further criteria of its value. They hope, too, that the data obtained in such studies may provide wool growers with a practical guide for selecting and breeding sheep that will produce wool of the quality that will bring the highest return.☆

4. Cleaning fleece is part of scouring process to remove dirt, grease, and suint (sweat salts). Before dry-cleaning, fleece is pulled apart in a duster-opener, given two rinsings. After cleaning, sample is again rinsed, then dried before carding. Laboratory is now changing from dry cleaning of wool to water scouring with detergents.

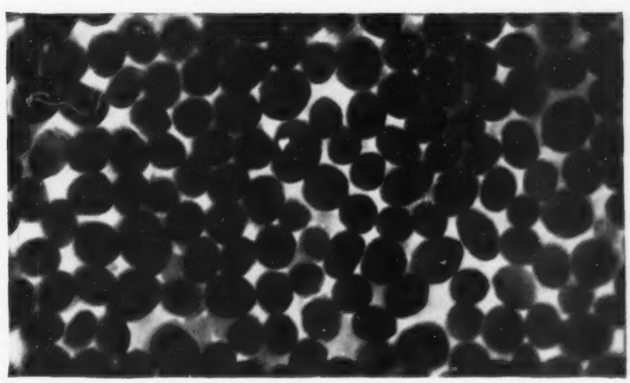
7. Combing separates the longer fibers of the wool (wool top) from the short, damaged, and tangled ones (noils). Combing eliminates practically all remaining foreign matter. The French comb shown here has been effective in processing the medium-fine wool of the Targhee sheep, is particularly useful in combing wools of various lengths.



8. Wool tops such as these are of uniform fineness and length and are used for worsted fabrics. Noils are used to blend with carded wools for woolens. Wool top from individual fleece matchings varies in yield. Within Targhee breed, developed by ARS breeding specialists, yields range from 86 to 91 percent of the carded wool.



11. A metal holder with a narrow slot, a device developed by ARS, is used in preparing cross sections of wool for determination of fineness. A photographic image of the cross section enlarged 500 times is projected. Diameters of fibers from selected areas of the cross section are then measured in microns (about 1/25,000 inch).



12. Cross section of medium-fine wool fibers (average diameter measuring 22.75 microns) enlarged 500 times. Wool fibers of U. S. are classified for fineness in numerical grades ranging from 80's (finest) to 36/40's (coarsest). The 80's measured 18.1–19.5 microns in diameter, and 36/40's measure 36.6–41.3 microns in diameter.

crops and soils

All-Season Forage

PASTURE MANAGEMENT STUDIES HELP DELTA COTTON FARMERS TO DIVERSIFY

A COTTON farmer in Mississippi is feeding 1,800 head of beef cattle for the winter market. From 400 acres of irrigated Delta land in Sudangrass, corn, and sorghum, he daily cuts 90 tons of forage, which he feeds by the soiling method.

Many other farmers in the Mississippi Delta area who once depended almost entirely on cotton as their main cash crop have now turned to raising livestock. Diversification is expanding. The heavy clay soils, common to this area and always a poor risk for cotton production, are being profitably utilized today.

Research in many fields—forage crops, feeding methods, land use, and irrigation—has made this trend possible. Much work has been done through Federal-State cooperative effort at Mississippi's Delta Branch Experiment Station at Stoneville. The results are widely applicable in the Mississippi, Louisiana, Missouri, and Arkansas Delta lands. These areas are generously supplied with ("buckshot") heavy clay soils, in addition to the lighter sandy loams used extensively for cotton.

Pasture research at Stoneville is being conducted under the direction of agronomist P. G. Hogg, assistant superintendent of the branch station. Researchers there have evolved a 3-way program to develop and test suitable legume-and-grass pasture combinations for (1) winter and spring use, (2) summer use, and (3) year-round use in terms of hay and silage as well as grazing.

One major goal has been to find and test pasture crops that would provide a full 9 months of grazing, leaving November, December, and January as the only months in which a feeder would have to supplement his grazing with silage or hay.

Winter and spring pasture combinations that have given good results at Stoneville are fescue and white clover, fescue and red clover, and fescue and common wild winter peas. Fescue alone has not done well in terms of beef gains per acre.

Successful summer test pastures are those of common or coastal Bermudagrass, or Johnsongrass, with red clover. Tests show that these grasses combine well with the clover, make good stands, respond to irrigation, and supply good yields for hay or grazing. They can be overseeded with wheat in the winter. Wheat has given better winter grazing than the commonly used ryegrass and, at the same time, offers less competition to the perennial sod.

Researchers have had good results in late-winter and early-spring grazing or hay crops from wheat fall-seeded in the Johnsongrass-red clover combination. Livestock could graze the wheat during winter and early spring; then the aftermath of wheat, red clover, and Johnsongrass was cut for hay or silage in May, and the pasture was ready for summer grazing in early July. This over-all combination—Johnsongrass and red clover with wheat—gave green pasture for about 9 months of the year.

For the remainder of the year, silage of sorghum or other crops provided the necessary roughage. New varieties of sorghum used in experimental work at Stoneville provide a high level of *total digestible nutrients*—with yields running 20 to 30 tons per acre for silage.

The Stoneville researchers have worked out for irrigated lands a rotational grazing plan that has proved profitable in actual use. As a result, the plan has been recommended to farmers in the Delta area.

This plan involves division of pasture into three fields as a minimum on which to graze cows one-third of the time. At the start, each pasture is grazed for 7 days. Then it's clipped to uniform height, irrigated, and fertilized (30 pounds of nitrogen is applied per month), and permitted to rest for 14 days.

Experience shows that 4 to 5 inches of water in one irrigation will carry the pasture a month. Heavy infrequent irrigations reduce the cost of application. At Stoneville, an effort is made to irrigate as quickly as possible after the soil shows cracks up to 1½ inches wide. These cracks help aerate the soil and encourage more rapid absorption of water. Otherwise, the soil becomes waterlogged and yields decline.☆

HOW TO TELL WHEN CORN WILL MATURE

■ USDA RESEARCH is helping Corn Belt farmers predict in midsummer whether they must plan ahead to dry their corn crop artificially.

Central Iowa farmers who've planted corn on time and want to machine-pick it moist for artificial drying, now can closely estimate when to pick. As early as the pollination or water-blister stage, they can tell when kernels will dry to the desirable 30-percent moisture.

Weather has an important influence on rate of drying from 25 percent down to 20 or 21 percent moisture—highest moisture safe for cribbing corn that's to be held into the following spring. That phase of drying may vary as much as 3 weeks.

Recent restudy of some old experimental data on kernel moisture gives us some midseason guides in estimating whether a stand of corn will field-dry enough for safe warm-weather storage and, if so, just about when it will reach that dryness. Kernel moisture was checked at frequent intervals in six crops from 1940 to 1947 in Central Iowa. ARS researcher J. L. Schmidt discovered the similarity of drying patterns recurring in the different tests over the years.

There's no exact gauge. Drying rate decreases as moisture in the corn goes down. Drying rate changes fairly consistently within a certain moisture range, but weather (cool and damp or hot and dry) may greatly influence rate of change in the early stages of drying and again below the 25 percent-moisture level.

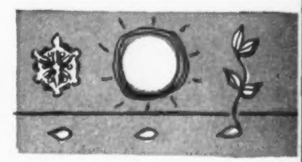
When planted at the ordinary time, corn dries about as follows:

From water blister (88 percent moisture) to beginning-roasting-ear stage (75 percent), moisture normally declines an average of 2 percent per day and takes about 6 days—subject, of course, to the weather factor. It takes 21 days to pass from the roasting ear or milk stage (75 percent) through the complete dent (50 percent). That averages a 1.20-percent loss per day. Maturing and drying from 50 to 25 percent is largely independent of weather. Drying occurs at about 0.75 percent per day and takes about 33 days. Final drying down to 20 percent moisture occurs under usual conditions at the rate of about 0.25 percent per day, but may take anywhere from 7 to 26 days.

Suppose corn is just beginning to dent on August 28. It has about 60 percent moisture and will take about 35 days or to October 2 to dry to 30 percent. Or it will take this same corn 48 to 67 days, depending on weather, to dry all the way down to the 20-percent level safe for storage into warm weather. That means October 15 to November 3.

If the corn has been planted late and doesn't start to dent until the last half of September, there's little prospect of it reaching 20 percent moisture in the field until late December or January. That's too late, and the grower had better start counting on a late November harvest and artificial drying of his corn crop.☆

WHAT MAKES THE HARD SEEDS SPROUT



■ SLOW SEED GERMINATION may hinder but sometimes helps self-renewal of an old stand of hard-seeded crops like Ladino clover.

At USDA's Regional Pasture Research Laboratory, State College, Pa., R. R. Robinson found temperature fluctuation alone—not amount of oxygen or carbon dioxide present—controls hard-seed germination.

Seeds kept at constant temperature in the laboratory wouldn't germinate. Kept at about 35° F., but warmed to 70° for just 4 hours once each week or each day, some germinated after each warmup. After months of cold, a 1-day warmup caused many seeds to germinate—3 consecutive warmups, nearly complete germination.

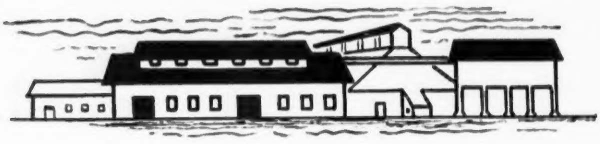
Outdoors, the usual cycle of warm days and cold nights after fall seeding—best time for the South—caused some shallow-planted seeds to sprout each day. A long cold period occurring after natural reseeding in the North brought about a nearly complete sprouting after about the second warm day of spring.

The deeper the seeds are within the soil, the better they are insulated against temperature change. Buried 6 inches, hard seeds may stay dormant even with abundant moisture.

This seed behavior explains why Ladino clover reappears in new-plowed fields years after turning under an old stand. It also shows that stand renewal is favored by nontillage or barely covering seeds.☆

BETTER GINNING

THROUGH RESEARCH



USDA engineers have had a hand in designing modern gins that do more jobs in less time

ONCE the only function of a cotton gin was to separate lint from seed. Modern gins still perform this task—and many more. New functions have been added largely because cooperative research by USDA and industry has anticipated many requirements even before modern methods of harvesting made them necessary.

Modern gins first condition cotton—adjust its moisture content to the proper level—for processing. Then they remove burs, green bolls, sticks, leaves, rocks, and even tramp iron. They clean and reclean the cotton before lint and seeds are separated—in the only part of the gin that inventor Eli Whitney might recognize.

But his basic idea remains. His circular saws and ribs still remove lint from seed. And changes in tooth design, rotation speed, and other refinements have made these saws and ribs capable of many additional tasks.

Research that has advanced ginning to its present state of efficiency began about 25 years ago. Important initial steps included development of a process for drying seed cotton before ginning, along with machines to do the job. The process and machines, both devised by USDA engineers, eliminated costly gin stoppages caused by cotton that came from the fields too wet to gin. Further advances came with the invention of improved pneumatic unloading systems for even distribution, a special seed-cotton cone fan, small-pipe seed-handling system, and suction driers. Now widely used are a lint cleaner, a stick remover, and a seed-cotton cleaner.

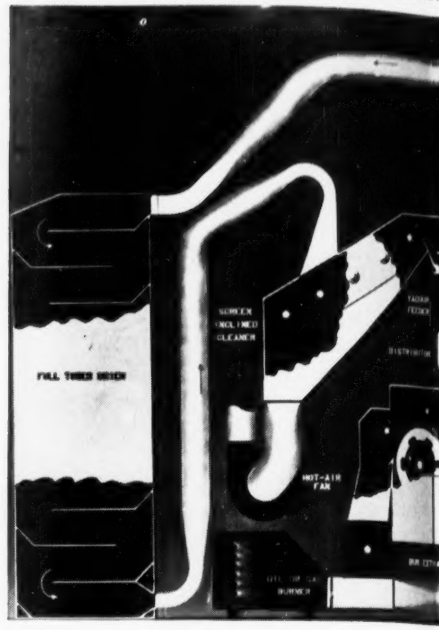
Another USDA invention is the recipro-cleaner addition to the gin stand. This removes troublesome "motes," as well as tiny particles of trash that get tangled in cotton fibers and lower grade and hamper spinning.

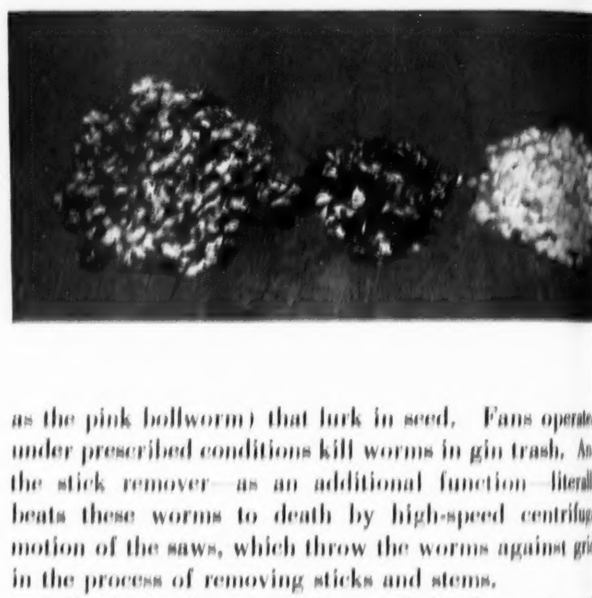
Control of cotton-damaging insects has become a part of modern ginning. Seed sterilization kills insects (such as the pink bollworm) that lurk in seed. Fans operated under prescribed conditions kill worms in gin trash. And the stick remover—as an additional function—literally beats these worms to death by high-speed centrifugal motion of the saws, which throw the worms against grids in the process of removing sticks and stems.

Collectively, these inventions and developments make it possible nowadays to gin high-quality lint from rough-harvested cotton. Only 10 years ago, the best gin could not have produced from mechanically harvested or hand-snapped cotton a lint that rated better than two grades below the lint produced from hand-picked cotton.

Cooperative effort is being continued toward still greater improvement of our ginning equipment. Research must lead the way to (1) high-speed, low-cost gin

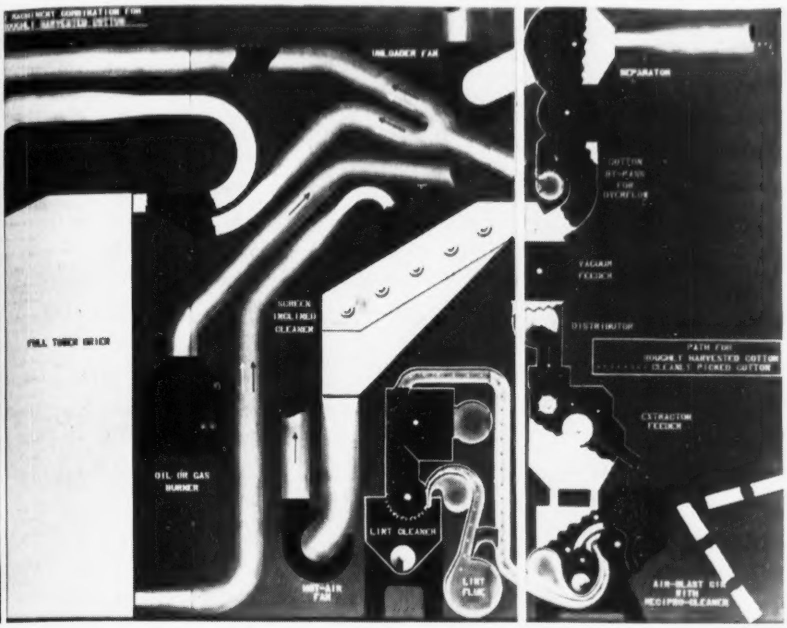
1. Efficient cleaning and ginning of rough-harves ton—machine-stripped or hand-snapped—take machinery shown in this diagram of a modern cott



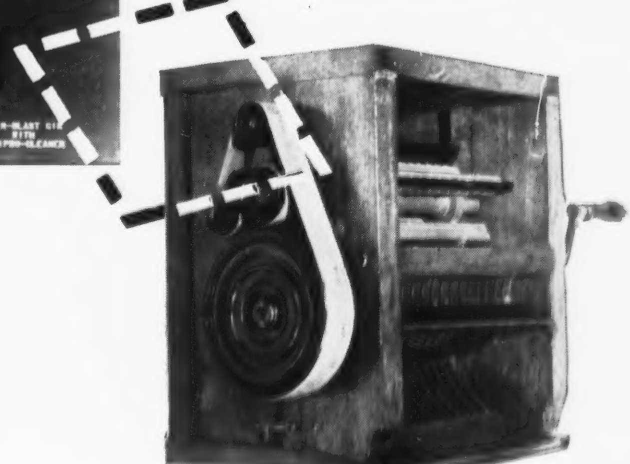


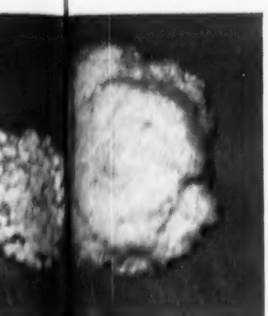
2. Machine-picked cotton—as harvested by spindle-pickers—needs machinery shown below in center portion of this diagram, plus that shown at right.

3. Hand-picked cotton is ginned efficiently in part of gin shown below.



ALL THAT REMAINS in a modern gin of Eli Whitney's original invention for separating seed from hand-picked cotton is indicated at left. The principles in this modern version are the same as in a model of Whitney's gin that's shown below. This model, thought to have been made by Whitney before 1800, was given to the Smithsonian Institution's National Museum, Washington, by Eli Whitney, Jr.





HEAVY TRASH CONTENT of cotton machine-stripped or hand-snapped is big ginning problem. Such rough-harvested cotton, first pile, contains as much as 50 percent trash, second pile. Cotton in third pile is hand-picked. The clean lint in fourth pile can be obtained with minimum of machinery with hand-picked cotton. Only most modern gin produces such lint from rough-harvested cotton.

ning of extra-long-staple cotton; (2) better conditioning of seed cotton before ginning; (3) 100-percent kill of pink bollworms in seed cotton brought to the gin; (4) some means of removing grass from lint; and (5) development of instruments and methods for controlling the movement and conditioning of cotton throughout the ginning process.

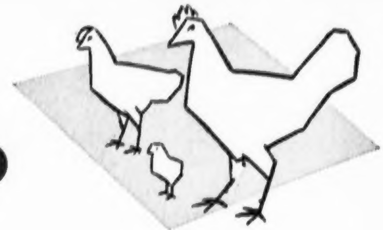
Many of the ginning improvements that have been devised by USDA engineers are available to the industry through public patents held by the Department. These patents have helped make the ginning industry big business today. Small plantation gins have about disappeared. Replacing them are large, modern crossroads gins to which seed cotton is brought directly from surrounding farms.

A quarter-century ago there were about 18,000 cotton gins in the United States, each costing about $10,000. This has shrunk to about 7,300 gins with an average cost of about $100,000. Twenty-five years ago, gin capacity was about 6 pounds of seed cotton per saw per hour. Modern gins turn out 9 pounds per saw per hour, and the number of saws has increased from a top of about 280 to 450 per plant. Modern gins frequently have 4 to 5 stands as compared with 2 to 3 a few years ago.

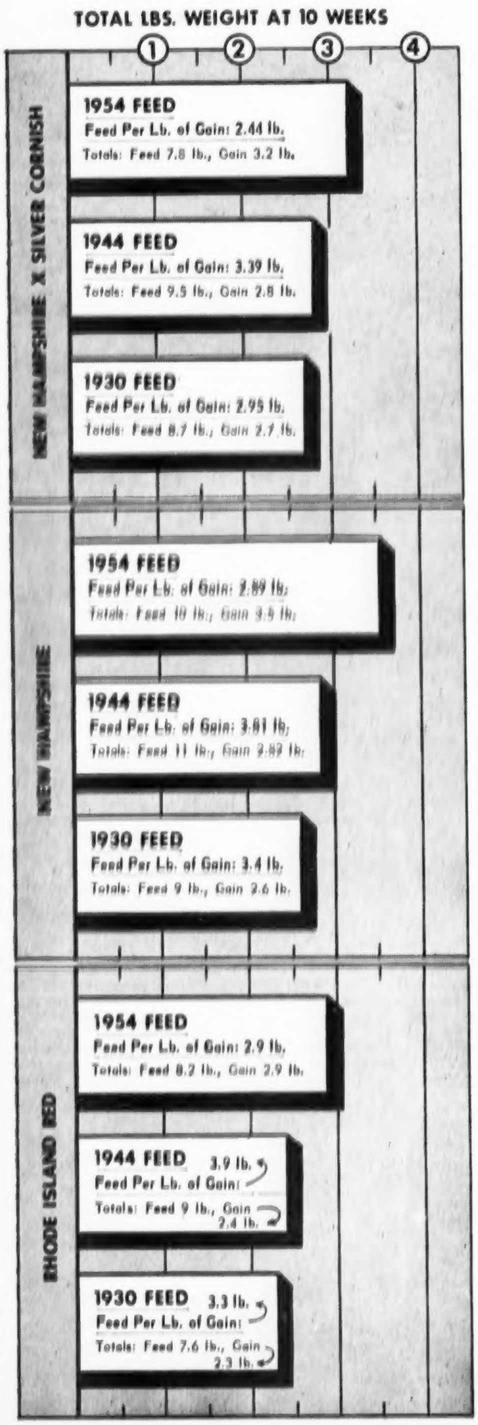
Federal research in most phases of ginning began in USDA's Cotton Ginning Laboratory at Stoneville, Miss. At the USDA laboratory at Mesilla Park, N. Mex., and the State-Federal laboratory at Chicasha, Okla., research covers special problems related to cotton varieties and types, and harvesting methods in those areas. A fourth laboratory near completion at Clemson, S. C., will similarly serve growers in the Southeast.☆

poultry

MORE POUNDS ON LESS FEED



That calls for the latest in diet, breeding, care



THE combination of up-to-date feeds, modern strains, and good management produces a pound of poultry on *less* than 3 pounds of feed.

Just 10 years ago, this gain-and-feed ratio was running 1 to 4.

By 1953, our commercial broiler producers were getting 1 pound of bird for each 3 pounds of feed.

In experiments recently completed at Beltsville, Md., USDA poultry nutritionists R. J. Lillie and J. R. Sizemore got a pound of broiler with less than 3 pounds of a 1954 diet fed to old and new strains of poultry. And in one instance, the researchers used less than 3 pounds of a 1930 feed to produce a pound of gain in a modern strain of chickens.

Test feeds selected for the ARS trials included one formula representative of good poultry feeds in 1930, another used widely in 1944, and a third that was developed and fed in 1954. The 1944 feed was largely an emergency ration developed for use during the war when high-quality ingredients were scarce.

Rhode Island Reds, New Hampshires and New Hampshire-Silver Cornish crosses were used as test birds. The Rhode Island Reds represented a strain that was established at Beltsville in 1925 and has since been selected for egg production rather than rapid growth. The New Hampshires had been bred for both rapid growth and feed efficiency. The crossbreds of the third lot represented an experimental cross of New Hampshires and Silver Cornish stocks developed at Beltsville (AGR. RES., February 1955, p. 8).

For the tests, researchers separated the chickens so that one lot of each breed (or crossbreed) received one of the feeds. All groups were placed on feed as day-old chicks.

Results were checked at 10 weeks. Irrespective of breed, the birds grew best on the 1954 feed, followed in order by the 1944 diet and the 1930 diet. The 1954 diet also gave the best feed efficiency, whereas the 1930 diet was more efficiently utilized by the birds than the 1944 feed.

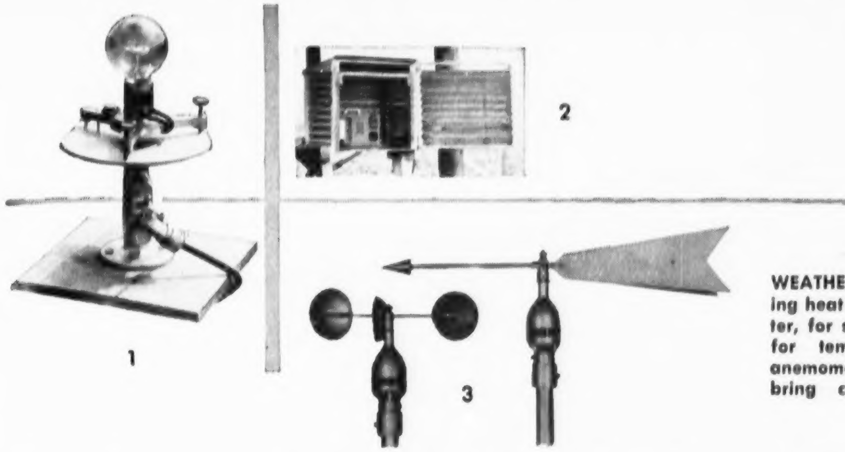
The 1954 feed is a high-efficiency diet containing added fat and such feed additives as choline, methionine, and antibiotics. These were not used in the earlier rations.

At 10 weeks, the crossbred chickens on the 1954 diet had gained 3.2 pounds on 7.8 pounds of feed. The crossbreds gained 2.7 pounds on 8.7 pounds of 1930 feed and 2.8 pounds on 9.5 pounds of 1944 feed.

The New Hampshires gained 3.5 pounds on 10 pounds of 1954 feed, against 2.6 pounds of gain on 9 pounds of 1930 feed, and 2.9 pounds of gain on 11 pounds of 1944 feed.

The Rhode Island Red birds gained 2.9 pounds on 8 pounds of 1954 feed, compared with 2.3 pounds on 7.6 pounds of 1930 feed, and 2.35 pounds on 8 pounds of 1944 feed.

Genetic growth improvement was indicated by the tests. Both the New Hampshires and the crossbreds made better gains on all three feeds than did the Rhode Island Reds. In feed efficiency—pounds of feed per pound of gain—the crossbreds used the smallest amount of feed in relation to their total gains.☆



WEATHER INSTRUMENTS check factors affecting heat gain or loss in cattle—(1) pyrheliometer, for solar radiation; (2) hygrothermograph, for temperature and humidity; and (3) anemometer and windvane, for winds that bring cattle moisture-absorbing fresh air.

Cattle researchers watch the weather

THIS STATION'S RECORDS ARE ESSENTIAL IN BREEDING CATTLE TO PRODUCE MILK OR BEEF IN WARM CLIMATES

EFFORTS to develop crossbreeds of dairy and beef cattle that will do well in the warm, humid Gulf Coast area are being aided by modern weather-recording equipment at USDA's Iberia Livestock Experiment Station at Jeanerette, La.

This "weather station" boasts a pyrheliometer, which measures radiation of the sun. In addition, there's the usual array of instruments such as gauges, thermometers, and recorders that provide an hourly and daily record of weather changes.

The weather records help check on the heat-tolerance of various cattle breeds and crossbreeds. These records are used to evaluate four major factors that affect heat gain or loss in cattle: (1) air temperature, (2) vapor pressure, (3) air movement, and (4) solar radiation.

Researchers at Jeanerette are concerned with air temperatures that run over 85° F. Cattle are forced to lose extra heat when air temperature approaches or exceeds body temperature. Cattle neither sweat nor pant much but they may get some cooling effect from faster respiration rates and evaporation of water from the lungs and air passages.

The effect of changes in vapor pressure—absolute humidity of the air—is important as a means of determining heat gains or losses in test animals. Evaporation of moisture by the air cools animals, of course. The ability of air to absorb moisture decreases as vapor pressure increases.

Wind velocity records obtained are important in studying the cooling effects on cattle of various wind speeds. Findings so far indicate that "gentle" breezes of less than 5 miles per hour benefit cattle most. Little additional cooling effect on cattle is gained from greater wind velocities.

Researchers watch solar radiation closely with the aid of the pyrheliometer. When solar radiation is high, the cattle must bear an extra heat load—comparable to an additional 12 to 15 degrees of air temperature. Under such conditions, the animals usually require shade or some other protection. The pyrheliometer, however, permits researchers to determine the relative ability of different breeds and crossbreeds to tolerate the additional heat loads imposed on animals by high radiation.

One of the major problems is to develop cattle that will produce milk or beef under hot weather conditions. Cattle breeds, dairy and beef, developed in the European climates have not generally done their best when first introduced into the Gulf Coast area. The crossing of European breeds with milk and beef breeds of hotter, more humid climates such as those found in India and Africa, is being investigated as a means of developing the heat tolerance necessary for good production.

Beef cattle breeding, using Brahman and Africander breeds to provide heat tolerance, and European beef breeds to supply beef-producing qualities, has progressed satisfactorily for some years at Jeanerette. Because of this and other supporting research, heat-tolerant crossbreds are increasing in number in this area.

Research in dairy cattle for the Gulf Coast region has also made progress since the introduction in 1946 of heat-tolerant Red Sindhi cattle from India. They are being crossed with European breeds of dairy cattle.

In both beef and dairy cattle research work, in which the Louisiana experiment station is closely cooperating with USDA, the weather-recording equipment is essential.☆

food and home

Frozen fried chicken—how does it keep?

HERE'S A POPULAR PRODUCT WITH A GREAT POTENTIAL AND WE'RE FINDING ANSWERS TO STABILITY PROBLEMS

FROZEN fried chicken that a housewife or chef can pop in the oven or deep-fat fryer and take out minutes later—crisp, tender, golden—is a popular item. In fact, its potential market has hardly been touched.

In an effort to increase this market, researchers at USDA's Western Regional Research Laboratory, Albany, Calif., are studying the stability of cooked poultry during freezing and frozen storage. The scientists are finding means of preventing or decreasing problems concerning flavor, tenderness, and juiciness.

Tests were made on halved fryers dredged in a mixture of wheat and potato flour before cooking. In two methods, the birds were *completely* cooked before freezing—by steaming or by frying in deep fat. In the third method, the birds were fried in deep fat for 1 minute—just long enough for the dredge to fix.

Findings to date show that the frozen fried or steamed chicken should not be held more than 6 months at 0° F. for top quality. Birds frozen after the 1-minute fry are stable for much longer periods. Cooking apparently accelerates a flavor change in the meat. Results also show that during processing birds should be held as short a time as possible at temperatures above freezing, to prevent development of a "fishy" flavor.

Buyer preference for fried, steamed, or 1-minute-fry birds would depend on the equipment available in the home or commercial concern. For home consumption, either of the frying pretreatments would be desirable because of the convenience of reheating in the oven. For commercial use where deep-fat-frying facilities are readily available, the steaming method might be advantageous.

Reheating in fat has a time advantage over reheating in the oven. Thawed halves can be reheated in a 450° F. oven in 15 minutes, in deep fat at 365° F. in 3 minutes. For unthawed birds, reheating takes approximately three times as long.

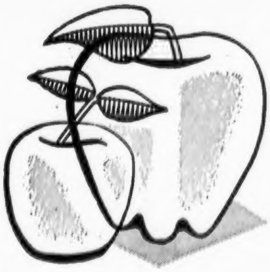
Weight gain of the birds following dredging averaged slightly under 4 percent. The weight loss following cooking depended on the cooking method. Birds fried in deep fat lost approximately 21 percent; those steamed at atmospheric pressure lost approximately 11 percent. Thus, there was a net loss of 17 percent for the fried birds, of 7 percent for the steamed birds. The 1-minute-fry birds showed no weight loss, just the 4-percent dredge gain.

Weight loss from reheating unthawed cooked birds was about 4 percent higher than in reheating thawed cooked birds. The total loss for birds given the 1-minute-fry pretreatment (whether thawed or unthawed) was less than that of the birds completely cooked before being frozen and reheated, and approximately the same as that of birds cooked fresh.

Research showed that flavor changes occurred in the meat rather than skin and were not related to development of rancidity in cooking fat taken up by birds. Holding the chicken in the absence of oxygen showed that the flavor change is at least partially oxidative. Holding at a high temperature (10° F.) produced rancid or "stale" flavor.

Perhaps more serious is the "fishy" flavor that appears in occasional lots. ARS tests show that fishiness can be induced in some lots by holding the birds for 24 hours or longer at refrigerator temperature, either before or after cooking.

Preliminary work indicates that prolonged holding of cooked birds before freezing is more detrimental than holding uncooked birds. Thus, processing delays could contribute to development of fishiness and may offer a partial explanation of the problem. Tests are also underway to see if variations in commercial feeds are related to fishiness.☆



APPLE HANDLING MADE EASIER

Equipment, specialized picking crews raise efficiency

LACKING a machine to harvest apples as efficiently as mechanical harvesters pick cotton, Michigan apple growers are taking advantage of newly developed labor-saving hand methods and specialized crews.

Combined with mechanical aids, the new harvesting system promises an increase in picker efficiency of 5 to 10 percent. The methods were devised cooperatively by USDA and Michigan experiment station engineers and tried experimentally in Michigan last year. A similar project in harvesting and orchard handling has been started in cooperation with the Tree Fruit Branch of the Washington State experiment station.

Stressing specific tasks among picking crews, the system also employs the advantages to be found in labor-saving equipment such as conveniently handled pallet boxes, low-hung trailers, and fork lifters.☆

1. A ground crew of five begins harvest of this Golden Delicious apple tree. Workers do not carry or use ladders. "Take" from tree was about 11 crates—little over half its total yield. Unskilled help can work effectively in a ground crew.

2. A mid-section crew of four takes over with 6-foot ladders, which are short and light-weight. Crew picks all the fruit that can be reached from this length and then moves on to the next tree. In this case the apple yield totaled about 5 crates.

3. The top-section crew, also of four, moves in and completes harvest—amounting to another 5 crates. They use their long ladders continuously and more effectively than would be true if unharvested fruit were still in the bottom of tree.

4. Apples are poured into pallet crates, carried through orchard on a low-hung tractor-hauled trailer. Each pallet holds about 20 bushels and saves individual handling of the ordinary 1-bushel crates (used by specialized crews in test above).

5. Pallet crates are quickly loaded on truck by a tractor with hydraulic lift. Pickers like pallets: they take less leveling-off labor, eliminate orchard stacking. Cider apples—drops, defectives, too small—are also efficiently handled in pallets.

6. A fork-life truck unloads pallet boxes filled with hand-picked apples at processing plant. Use of these mechanical aids and specialized picking crews saves time and labor in orchard and at plant and speeds up placing fruit in cold storage.

Flowing Dust

FLUIDIZER DEVICE MARKS A BIG STEP TOWARD BETTER DISTRIBUTION OF DUST FROM PLANES

WHEN a housewife wants to divide potatoes evenly among her family, she often solves her problem by first whipping the potatoes. There's something of this same thought in the experimental work being done with aerial dusts by USDA researchers at the Insect Pest and Plant Disease Control Equipment Research Laboratory, Toledo, Ohio.

The usual method of applying aerial dust has been to tumble it groundward in a single stream from a point directly below the aircraft. Flow of the dry bulk material is induced by its own weight and regulated only by a gate release device that does not provide accurate metering.

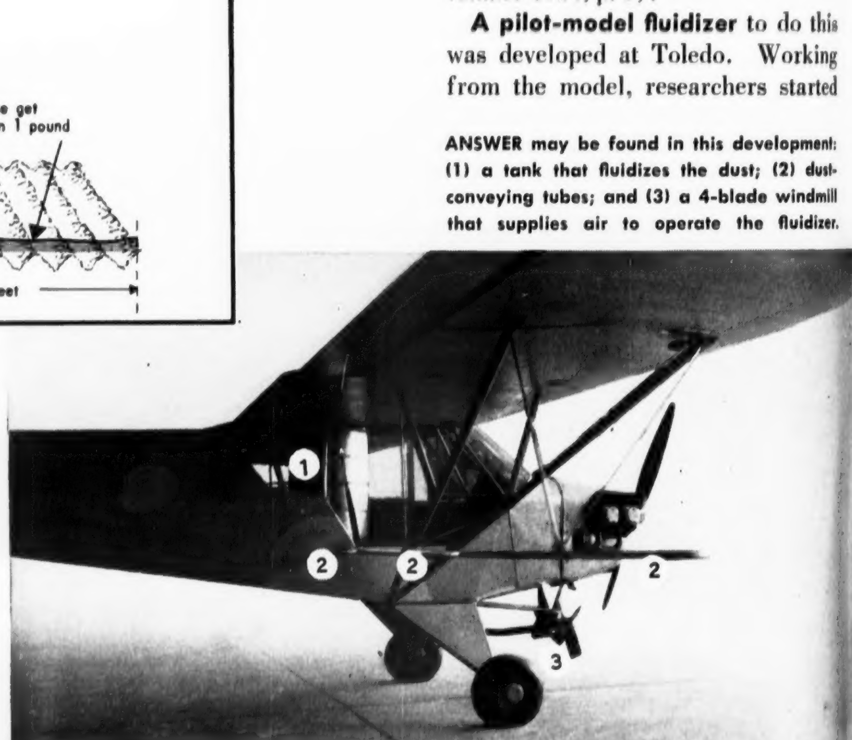
Although much effective work has been done in this way, it has many drawbacks. Dusts tend to concentrate in the center of the swath, narrow at best, for low flight elevations. This means more swaths for pilots to fly, to cover bare spots. It means uneven distribution patterns because dry bulk materials tumble out fast at first, then slow up as the amount of material in the hopper lessens. Some researchers have speculated on the reflection of this uneven distribution in data on residues in treated fields.

What the ARS researchers at Toledo are seeking is better lateral distribution of aerial dusts. These scientists want a wider swath and a more even distribution of the dust in each pass the plane makes over the field. The first step in this direction is to fluidize the dry bulk material into a liquid-like mass (AGR. RES., November 1954, p. 9).

A pilot-model fluidizer to do this was developed at Toledo. Working from the model, researchers started

PROBLEM in aerial dusting by usual way is uneven distribution. Dust tumbles out at varying rate, and center rows get an overdose.

ANSWER may be found in this development: (1) a tank that fluidizes the dust; (2) dust-conveying tubes; and (3) a 4-blade windmill that supplies air to operate the fluidizer.



looking for practical aspects of the design for a pesticide-dust fluidizer. They came up with a tank 20 inches in diameter and 30 inches high that can be mounted directly behind the pilot in a light plane.

In the bottom of the tank is bolted a conical section containing an air diffusing plate and an agitator. The agitator is driven (through a worm-gear reduction and a flexible drive shaft) from the air-supply-pump shaft. The air pump, powered from a four-blade windmill mounted under the plane just forward of the cockpit, supplies the air for the fluidizer. This pump also provides pneumatic pressure for an air cylinder that operates the conveying tube control gates found in the dust tank.

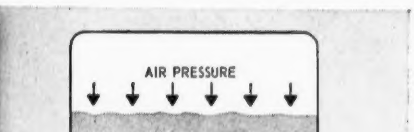
With pneumatic pressure maintained in the tank, fluidized dust flows at predetermined, accurately metered rates through small tubes located under both the fuselage and the wings.

Researchers George Sanders and Frank Irons believe the problem of maintaining an even flow of material from the tank has been cracked. Now they are trying to determine the best location of outlet tubes to provide a wider, more uniform swath pattern. They believe a trapezoidal swath deposit pattern would be most effective and would save materials by reducing bare spots in some places and overlapping in other places.

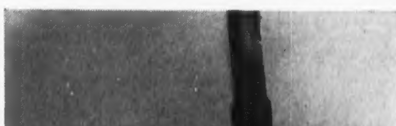
The researchers hesitate to say that the multiple-nozzle-type boom extending out to the wing tips—used in spraying—is the answer to the dusting problem. They say only that they will continue to try tubes in different numbers and positions until they come up with the combination that proves best. This, they point out, may finally be determined by the elevation from which the dust is applied. Since this varies, the final dust conveying and distributing design may have to be a compromise that achieves a practical optimum.

Sanders and Irons emphasize that further research is necessary in both laboratory and practical adaptation of the device before it can be accepted as a practical system for use on agricultural aircraft. But they believe that, once worked out, it may be adapted for distributing other solids such as seeds and fertilizers.☆

FLUIDIZER sends air up through material, causing it to expand into liquid-like mass. Air at top maintains pressure as dust level drops, keeps flow into conveying tube even.



DRY Dust resembles liquid coming from tube. Big problem now is to find the best location on plane for these outlet tubes, to get a swath pattern that is wide, uniform.



Found: how peach mosaic is spread

■ A MITE SO SMALL that it can't be seen without a microscope has recently been identified as the carrier of destructive peach-mosaic disease. Discovery of this mite was made by ARS entomologists L. S. Jones and N. S. Wilson and plant pathologist L. C. Cochran of Riverside, Calif., where they work in cooperation with the California experiment station.

The mite was first found beneath scales of retarded leaf buds on peach and plum trees. As shoot growth pushes from buds, loosening and flaring the scales, the feeding mites scatter on air currents. The virus is transmitted as mites transfer their feeding from infected to healthy trees.

Positive proof that the mite carries this virus of peaches and other stone fruits came after thousands of tests with over a hundred other insects. Within 2 weeks after the mites were transferred from diseased to healthy trees, symptoms of the virus began to show up in the healthy stock.

A cooperative USDA-States control program was started in 1934. Since then, more than 400,000 diseased trees have been destroyed in 8 Western and Southwestern States. Disease spread from nursery stock or budwood has been guarded against with a strict quarantine inspection and certification program. This program will not stop now. Instead, better control methods, other than the removal and destruction of trees, will be sought by researchers.☆

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agrisearch notes

SEVERAL INSECTICIDES—water soluble organic phosphates—appear effective against mosquito larvae in irrigation water. The effective ones are Bayer L 13/59, Shell OS 2046, para-oxon, parathion, and methyl parathion. They were tested jointly by USDA, the Arkansas experiment station, and the California Department of Health, in laboratory trials. L 13/59 also showed up well in preliminary field-scale tests.

One part per million of OS 2046 or 4 parts of L 13/59—the two most promising—is deadly to mosquitoes. All have a lasting effect, especially L 13/59.

Most insecticides are insoluble in water. That enables them to stick in the rain. But high solubility is necessary for use in irrigation water, so the chemical won't settle to the bottom.

HOGS FED RAW GARBAGE at any time in their life may not be moved interstate after January 1, 1956, except for slaughter and special heat treatment. Nor may products from such hogs be moved interstate unless specially heat treated or to be heat treated. This may lower value as much as 50 percent. USDA established the restrictions July 1, 1955, in Amendment 56 or BAI Order 383 (Revised).

That's to prevent spread of the virus disease VE (vesicular exanthema) which threatened the hog industry 3 years ago. Spread of the disease was traced to a virus in contaminated raw garbage.

Movement of hogs fed raw garbage has been restricted under Order 383 since July 1, 1953. But these restrictions were temporarily modified to permit interstate shipment of such hogs and their products if the animals had been fed no raw garbage for 30 days preceding shipment. Amendment 56 extended the modifications through next December.

ARS officials say the modifications in effect throughout 1954 and 1955 were necessary because satisfactory garbage-cooking equipment was hard to get. At that time 42 percent of the garbage-feeding premises were feeding raw garbage to 751,000 hogs.

VE is now limited mostly to a few premises in 39 counties of 6 States. Cooked garbage is fed in about 83 percent of the 14,000 garbage-feeding plants in this country, and more than 80 percent of the hogs fed garbage get it cooked. But experience indicates that *all* garbage feeders must cook their garbage if VE is to be completely controlled. Ample satisfactory cooking equipment will be available by January 1.

A GROWTH-REGULATING CHEMICAL, 3–Cl–IPC (chemically, 3-chloroisopropyl-N-phenyl carbamate) shows promise as a sprout inhibitor for potatoes.

Four varieties of potatoes—Chippewa, Kennebec, Irish Cobbler, and Katahdin—grew no sprouts when tested for 8 months with 3–Cl–IPC at 45° and 55° F. storage temperature at USDA's Plant Industry Station, Beltsville, Md. The chemical was not effective at storage temperatures of 70° and above.

This chemical also reduced storage rotting from 9.9 to 6.6 percent at 45° F. temperature, and from 8.6 to 5.8 percent at 55° F. storage temperature.

ARS won't recommend the treatment, of course, unless it's proven harmless.

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